12.0 Methods of Assessing the Biological Integrity of Surface and Groundwaters

12.1 STREAMS

12.1.1 Bacteria

The coliform group of bacteria is the principal indicator of suitability of a water for domestic, recreational or other uses.

Coliform bacteria are analyzed at the Public Health Laboratory using the membrane filter procedure. Coliform densities are reported as membrane filter count per 100 ml.

12.1.1.1 Coliform Bacteria

A. EQUIPMENT

Collection bottles for coliform bacteria (approximately 100ml). Sterilized and treated with sodium thiosulfate. These bottles are available at the Public Health Laboratory.

B. COLLECTION

1. Do not rinse the bottle ! Fill the bottle to the top of label, and cap tightly.

2. Complete the information required on the bottle label and enter required data into field notes.

C. FILTRATION None

D. PRESERVATION

1. Bacteriological samples should be iced or refrigerated at a temperature of 1 to 4 °C during transport to the laboratory.

2. Fecal and total coliform samples should not be held more than six hours between collection and initiation of analyses.

3. Care should be taken that sample bottle tops are not immersed in water during transit or storage.

E. PRECAUTIONS

1. When sampling surface waters, try to collect the water from a depth of 15.2cm (6in), while still leaving room at the top of the bottle for mixing. Avoid surface scum. Do not touch the insides of the bottle; keep the hands near the base of the bottle while sampling.

2. Do not collect samples from spigots that leak or contain aeration devices or screens. Flush the spigot for 3 to 5 minutes before collecting samples. Remove the cap aseptically from the sample bottle, hold the bottle upright near the base, and fill without splashing.

F. QUALITY CONTROL None

G. SPECIAL INSTRUCTIONS

Composite samples are never collected for microbiological examination. Data from individual samples show a range of values which composite samples shall not display.

H. REFERENCES: None

I. PROJECT: Intensive Surveys, Drinking Water

12.1.1.2 Fecal Streptococcus

The normal habitat of fecal streptococci is the gastrointestinal tract of warm-blooded animals. Therefore, the presence of fecal streptococci indicates fecal pollution. Fecal streptococci have been used with fecal coliforms to differentiate human fecal contamination from that of other warm-blooded animals. In the past, a ratio of fecal coliform to fecal streptococci greater than 4 indicated human fecal contaminants whereas a ratio of less than 0.7 suggested contamination by nonhuman sources. However, for various reasons the FC/FS ratio is not recommended by Standard Methods 18th Edition to be used in differentiating human from animal sources of pollution.

The field collection protocols are the same as for total coliform.

12.1.1.3 Iron and Sulfur Bacteria

The group of nuisance organisms collectively designated as iron and sulfur bacteria have the ability to transform or deposit significant amounts of iron or sulfur, usually in the form of objectionable slimes. They are studied because iron and sulfur slimes may be a problem in water treatment and distributions and may be bothersome in waters for industrial use, such as cooling and boiler waters.

Iron bacteria may cause, or be associated with the fouling or plugging of wells. Temperature, light, pH, and oxygen supply are critical to the growth of iron and sulfur bacteria. Under different environmental conditions some bacteria may appear as either iron or sulfur bacteria.

Iron bacteria appear as masses of brown slime with tinges of red. Iron bacteria may have an unpleasant odor. These bacteria obtain energy by the oxidation of iron from the ferrous to the ferric state.

Iron bacteria are identified with a microscope shortly after collection. Settle, centrifuge or filter samples drawn from wells and examine sediment microscopically for filaments and iron-encrusted filaments. For additional information, refer to Method 9240 for Iron Bacteria, Standard Methods for the Examination of Water and Wastewater, 18th Edition (1992).

The bacteria that oxidize or reduce inorganic sulfur compounds exhibit a wide diversity of morphological and biological characteristics. One group of bacteria anaerobically reduces sulfate to hydrogen sulfide and is single-celled. Another group uses hydrogen sulfide for chemosyntheses and is purplish green in color. Other groups may be filamentous and clear and aerobic. The most important sulfur bacteria are the sulfate reducing bacteria as they contribute to corrosion of water mains, and to taste and odor problems in water.

To collect sulfur bacteria scrape from exposed surfaces or sediment and examine microscopically. For identification and additional information follow Method 9240 for Sulfur Bacteria, Standard Methods for the Examination of Water and Wastewater, 18th Edition, (1992).